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Final Report - ERTS FOLLOW ON PROGRAMME

Introduction

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| 1.1 Title: | The Application of ERTS Imagery
to the FAO/Unesco Soil Map of the World |
| 1.2 Investigation Number: | 2810 M |
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| 1.6 Organization: | FAO, Rome, Italy |
| 1.7 Type of Report: | Draft Final Report |
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2. Techniques

Colour composite prints at approximate scale 1:1 000 000 covering a large part of West Africa were received in September 1976. The coverage consisted of 241 prints, including wide gaps due to excessive cloud cover. Most part of North Africa from North Morocco to Tunisia where soil erosion is a priority problem were not covered.

The imagery was used through visual analysis with a view to collecting additional information for the interpretation of the FAO/Unesco Soil Map of the World in terms of desertification mapping and assessment of actual soil degradation and degradation hazards. As already explained in the progress report (March 1977), the digitized analysis of soil, climate and boundary data which had been initiated on an experimental basis in South America, has been abandoned because the time for storage of data and financial resources required proved too great in relation to staff and budget available and the results achieved.

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3. Accomplishments

A World Map of Desertification was published as a basic document for the UN Conference on Desertification which took place in Nairobi from 29 August to 9 September 1977. The available Landsat imagery was thoroughly utilized to estimate and map the vulnerability of land to desertification on the fringes of the Sahara in West Africa. One copy of the World Map of Desertification is attached for information.

The Landsat imagery was also used in the FAO/UNEP project for World Assessment of Soil Degradation. The assessment started with Africa north of the Equator and will ultimately produce a world map at 1:5 000 000 scale showing the areas where soil degradation by wind or water erosion, salinity, waterlogging is active or presents a serious hazard. The assessment is essentially based on the FAO/Unesco Soil Map of the World, but the additional information from the Landsat imagery was valuable for improving the delineation of broad physiographic units presenting uniform soil degradation hazards such as dune encroachment, sheet erosion on large areas, overgrazing and degradation of natural vegetation around villages. Swamps and hydromorphic areas are not easily distinguished from irrigated areas unless the latter have geometric contours. Except in extreme cases of areas with a salt crust, saline soils can easily be confounded with other soils having a high reflectivity such as white sands, bare light coloured soils of alluvial fans.

There is little doubt however that Landsat imagery supported by a minimum of ground information provides an overall picture of some criteria such as geomorphology, hydrography, distribution of broad land use and vegetation types which, together with soil and climatic data, allow a reasonably accurate assessment of the form and intensity of soil degradation. A report of these findings and conclusions was attached to the first progress report on the project.

A more detailed study at 1:1 000 000 scale of soil degradation in Morocco was also compiled, using a black and white mosaic of ERTS I and the available colour composite Landsat imagery for the Central and Southern part of the country. The study resulted in a country map showing main physiographic units which were subsequently characterized in terms of their actual soil degradation and degradation hazards.

Systematic use of the Landsat imagery for interpreting the Soil Map of the World and land resources evaluation was hampered by the fact that of the imagery requested, only a partial cover of the region, for one season instead of two, was available.

The imagery is being used for specific special studies in FAO Headquarters in connection with field projects as follows:

- i. Erosion mapping in Benin,
- ii. Vegetation mapping in Guinea,
- iii. Preparing the soil map, scale 1:1 000 000, of Upper Volta.

Significant Results

From the above experience with the use of Landsat imagery for soil degradation assessment and mapping as summarized in the report attached to the March progress report, it may be concluded that direct identification and mapping of the various soil degradation forms and intensities from the colour composite imagery is generally difficult, if not impossible. The imagery, however, provides valuable information on some main environmental criteria which can be used in connection with other available field data to assess actual soil degradation and estimate soil degradation hazards.

5. Publications

- The World Map of Desertification (1:25 000 000 scale) together with a short explanatory note was published as a basic technical document for the UN Conference on Desertification;
- A map of Desertification (1:5 000 000 scale) for Africa, North of the Equator was also prepared for display at the Conference.
- A soil degradation map of Africa north of the Equator will be produced in draft form by the end of the year.

6. Problems

The main problems have been:

- 6.1 Shortage of staff to work full time on the project, due to budgetary stringencies.

6.2 Only partial delivery of the requested imagery; had it been realized that the NASA budget for imagery was limited to \$6 000, the order would have been made for a smaller region but covered in two seasons, to serve as a test case. Only the western part of Africa north of the Equator is covered and there are extensive gaps in the coverage. Additional imagery is being ordered for a total allocation not exceeding US\$8 000. Such allocation however will be insufficient for a total coverage of Africa north of the Equator in two seasons which would be the minimum requirement to make full use of Landsat imagery for systematic assessment of soil degradation.

6.3 From the technical side there are difficulties when using only simple techniques in correlating patterns on the images with the various forms of degradation. This requires further investigation, particularly on relations of such patterns with other environmental factors such as climate, vegetation, soils, geology.

7. Data Quality and Delivery

The quality is good and resolution is adequate for this study. The limitation in supply of images has restricted the area which could be examined.

8. Conclusions

The Landsat data are valuable in the study of land degradation and evaluation of land resources. Budgetary limitations have hampered our application of the imagery for a global appraisal and even for the whole of the priority region selected for this contract. (The imagery will continue to be utilized, and added to, for the ongoing project on soil degradation assessment.)